CO$_2$ supersaturation observed in the Martian lower atmosphere by MGS-Radio occultation technique - Preliminary results -

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CO2 supersaturation / condensation in Martian lower atmosphere

- Occurred in polar nights
- Associated with seasonal change of total pressure
- Results in formation of CO2 clouds and/or snow fall
Recent works

• Convective available potential energy (Colaprete et al. [2008, PSS])
  \(\rightarrow\) vertical integration of supersaturation, losing *vertical information*

• Hu et al. [2012, JGR]
  \(\rightarrow\) estimating CO2 mass deposited onto polar caps, and particle size, but not mentioned *degree of supersaturation*

Further detailed analysis of

• Vertical structures of supersaturation
• Occurrence of degree of supersaturation
Data

Radio occultation measurements by Mars Global Surveyor (1997-2006)

- Vertical profiles of pressure and temperature (~20000 profiles)
- Fine vertical resolution: <1km
- Temperature error: <~1K in the lower altitude
Sampling of Data

- Inhomogeneous (sparse) sampling, because sampling highly depends on the relative geometry among MGS-Mars-Earth locations.
- Supersaturation events are found even outside of the polar night borders.
Longitude-altitude dependence of supersaturation occurrence

Distinct longitudinal structures:
- NH→“tall” supersaturation events (over 15km or 100Pa) at 120-180E and 330-360E
- SH→frequent supersaturation at 300-360E

Effect of topography and/or transient waves [Kuroda, private communication]?
Occurrence of high degree of supersaturation in NH&SH

SH has more frequent events with high degree of supersaturation → suggesting the hemispheric difference of the density of condensation nuclei (i.e., dust)?
Summary

• Supersaturation events have not only longitudinal but also vertical dependences

• Southern hemisphere has more frequent occurrence of severer supersaturation events than the northern hemisphere.
  → suggesting the hemispheric difference of dust density or/and transport?

• Future works:
  – Using other data like MRO-RS and MRO-MCS CO2 clouds (cf. Hayne et al., [2012]) to confirm the results based on MGS-RS
  – Analysis with the aid of model outputs